Lusardi et al., 2020: Temperature and juv Coho Survival

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Species Information

Common Name: Coho Salmon
Genus: Oncorhynchus kisutch

Stressor Details

Stressor Name: Temperature
Units: °C
Metric: MWMT
Scale: linear
Function Type: continuous
Vital Rate/Process: Survivorship

Life Stage & Context

Life Stages: Fry
Geography: Shasta River basin, California
Activity: Rearing
Season: Summer (July - Sept)

Descriptions

Overview

> Lusardi et al. (2020) found that Coho mortality increases as the MWMT rises.
> • Low Mortality: 0% observed at MWMT of 16.0–18.9°C.
> • Elevated Mortality: ~13% observed at MWMT of 24.0°C.
>
> Simple Modeling Approach: Develop a logistic function where mortality probability (P mort) increases as the 7-day moving average of maximum temperatures exceeds ~20°C.

Function Derivation

> Enclosure experiment

Transferability of Function

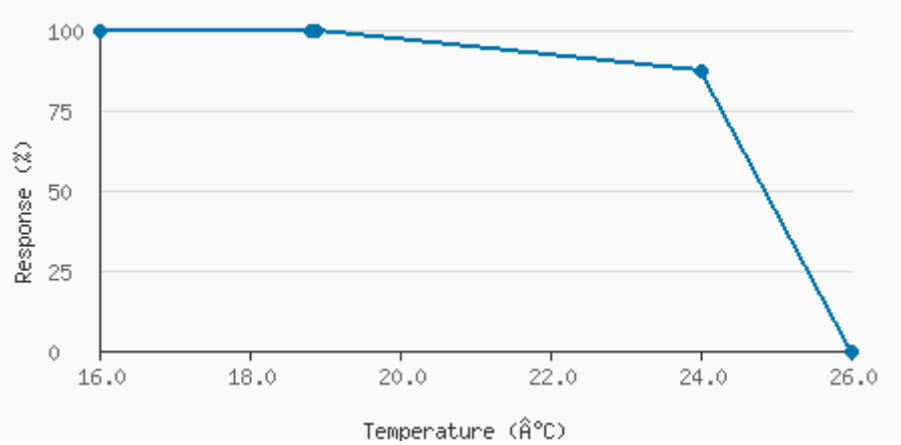
> Potentially generalizable with review.

Source of Stressor Data

> To reach the conclusions regarding mortality and Maximum Weekly Maximum Temperature (MWMT), Lusardi et al. (2020) conducted a 63-day in situ enclosure experiment during the summer low-flow period (July 9–September 9, 2013) in the Shasta River basin, California.
> The nature of their experiment involved the following key components:
> 1. Natural Thermal Gradient Selection The researchers established five study reaches along a 10-km segment of the river to exploit a natural thermal gradient created by large-volume cold-water spring inputs.
> 2. Experimental Enclosures They constructed 25 mesh enclosures (mesocosms) directly in the streambed (5 per reach).
> 3. Monitoring and Analysis Over the 63-day period, the researchers continuously logged water temperatures to calculate the MWMT for each reach. They monitored the enclosures every two days to document mortalities.

> The study concluded that while food availability was the primary driver of growth (mitigating negative effects on mass gain even at high temperatures), mortality was reliably driven by the thermal stress represented by MWMT.

Stressor Response Data



Raw Stressor Values	Scaled Response Values 0 to 100	SD	low.limit	up.limit
16	100	0	0	100
18.8	100	2	0	100
18.9	100	8	0	100
24	87	8	0	100
26	0	0	0	100

Citations

Lusardi, R. A., Hammock, B. G., Jeffres, C. A., Dahlgren, R. A., & Kiernan, J. D. (2020). Oversummer growth and survival of juvenile coho salmon (Oncorhynchus kisutch) across a natural gradient of stream water temperature and prey availability: an in situ enclosure experiment. Canadian Journal of Fisheries and Aquatic Sciences, 77(2), 413-424.

References

Lusardi et al., 2020 - https://cdnsciencepub.com/doi/full/10.1139/cjfas-2018-0484?casa_token=WrKZ7rRu2sIAAAAA%3AmXt9zjrpNT8LSekL76oo0DnBaGNNeBBM46xX-BG5LYyJI_zvZ0OhgSLdPUq1TcT0rgokDkxkPzbS